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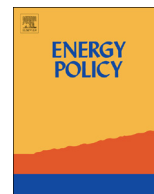
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Fuelling expectations: A policy-promise lock-in of UK biofuel policy

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HIGHLIGHTS

- Controversy over EU-wide biofuel policy resonated within the UK.
- At issue was how to stimulate future 2nd-generation biofuels.
- The government defended targets for 1st-generation as necessary to stimulate industry.
- Parliamentary Committees opposed biofuel targets as locking in 1st-generation.
- The UK government's stance illustrates a 'policy-promise lock-in'.

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ABSTRACT

Controversy over EU-wide biofuel policy resonated within the UK, fuelling policy disagreements among UK public authorities. They disagreed over how to protect a space for future second-generation biofuels, which were expected to overcome harm from first-generation biofuels. The UK government defended rising targets for available biofuels as a necessary stimulus for industry to help fulfil the UK's EU obligations and eventually develop second-generation biofuels. By contrast, Parliamentary Select Committees opposed biofuel targets on grounds that these would instead lock-in first-generation biofuels, thus delaying or pre-empting second-generation biofuels. Those disagreements can be explained by different institutional responsibilities and reputational stakes towards 'promise-requirement cycles', whereby techno-optimistic promises generate future requirements for the actors involved. The UK government's stance illustrates a 'policy-promise lock-in', a dilemma whereby promised support is a requirement for credibility towards technology innovators and thus technoscientific development – but may delay the redirection of support from incumbent to preferable emerging technologies. Thus the sociology of expectations – previously applied to technological expectations from technology innovators – can be extended to analyse public authorities.

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1. Introduction

In 2003 the European Commission issued the first EU Biofuels Directive, initiating an EU-wide biofuel policy (EU, 2003). The Directive set non-binding "reference" targets through 2010, requiring increasing proportions of all diesel and petrol sold in Member States to be biofuels. By 2003 biofuels were promoted as means to mitigate climate change, enhance fuel security in road transport and foster the rural economy. Abiding by its EU commitments, in 2005, the UK government announced the future implementation of the Renewable Transport Fuel Obligation (RTFO), whose mandatory

targets started incentivising biofuel production from 2008 onwards. Explicitly "cautious" in its support to available biofuels, the UK government set RTFO targets lower than those demanded by the EU and by the new-born UK biofuel industry.

During 2006–08 an international controversy erupted on whether biofuel expansion would enhance environmental and socio-economic sustainability, given biofuels' dependence on unsustainable biomass feedstock. Despite the controversy, the EU set a higher "binding" target for "renewable" transport fuels by 2020 (EU, 2009red), amidst expectations that these would be mainly biofuels in practice.

Facing tensions between its EU obligations, its dependence on the biofuel industry and prominent critics of biofuel targets, the UK government resisted calls for a policy moratorium by encouraging three related expectations. First, future 'advanced' or 'second-generation' biofuels would eventually use non-food biomass, thus overcoming the environmental and socio-economic problems of

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currently available 'conventional' or 'first-generation' biofuels. Second, future sustainability standards would soon ensure and certify biofuels' sustainability. Third, current biofuel targets would stimulate UK industry to eventually develop second-generation biofuels. The latter expectation was shared by the European Commission and the biofuel industry but was strongly rejected by two Select Committees of the UK Parliament – the Environmental, Food and Rural Affairs Committee, and the Environmental Audit Committee. Despite its previous commitments to the EU and industry, the UK government eventually slowed down UK biofuel targets in 2009, thus accommodating biofuel critics. The UK's slow-down prefigured the European Commission's 2012 proposal to limit the inclusion of first-generation biofuels to half of the 2020's target (EC, 2012).

This paper looks at how the EU-wide biofuel controversy resonated within the UK, especially through policy disagreements among UK public authorities. The paper addresses the following questions:

In shaping UK biofuel policy, what were the different accounts and policy roles of expectations for future technology?

How do such expectations help to explain UK biofuel policy, its tensions and shifts?

Uncontroversial per se, technological expectations were differently deployed for divergent stances towards UK biofuel policy. We argue that these distinctive deployments relate to different institutional responsibilities towards 'promise-requirement cycles', whereby techno-optimistic promises generate future requirements for the actors involved (van Lente, 2000). In particular, the UK government's stance relates to a dilemma that we call a 'policy-promise lock-in', a concept which has broader relevance.

The paper has the following structure. Section 2 introduces analytical perspectives, especially the 'sociology of expectations' framework, reputational stakes of public authorities, and our research methods. Sections 3–6 present the UK biofuel debate among UK public authorities. Section 7 relates our findings to previous literature. Section 8 interprets our findings as a 'policy-promise lock-in'.

2. Analytical perspectives and methods

To address the above questions, the paper elaborates concepts from the sociology of expectations and from previous analyses of UK biofuel policy, especially regarding reputational stakes, as outlined in this section.

2.1. Technological expectations: promise-requirement cycles

The sociology of expectations has been applied mainly to analyse expectations from technology innovators. Such factors include scientists and industrialists, especially "innovation players whose hopes and efforts are invested in the success of new technologies" (Pollock and Williams, 2010: 2). With some adaptations, the literature also offers insights for analysing how public authorities strategically use technological expectations, as this section explains.

As "real-time representations of future technological situations and capabilities" (Borup et al., 2006: 286), technological expectations can be viewed as resources strategically "used to do things" (van Lente, 1993: 185). More than simply cognitive, "expectations can be understood as performative" (Borup et al., 2006: 286). Performativity refers to expectations' power in fostering cooperation and providing direction for decision-making, thus potentially shaping or facilitating future technological developments (Borup et al., 2006; Brown et al., 2003; van Lente, 1993; van Lente, 2000).

More than simply describing future realities, expectations "guide activities, provide structure and legitimation, attract interest and foster investment. They give definition of roles, clarify duties, offer some shared shape of what to expect and how to prepare for opportunities and risks" (Borup et al., 2006: 286). They play a central role in mobilising resources at the macro level, "for example in national policy through regulation and research patronage" (Borup et al., 2006: 286). Related terms such as technological "promises" and "visions" emphasise their enacting, performative character: "expectations are wishful enactments of a desired future" (Borup et al., 2006: 286), i.e. actions meant to realise such a future.

When widely shared, expectations can become a "depersonalized social construction" not attributable to specific individuals or groups of actors, and "part of a generalised and taken-for-granted social repertoire" (Konrad, 2006: 431). For instance, "technologies presented as the next generation... are self-justifying because the notion of next generation is widely accepted" (van Lente and Rip, 1998: 222–223). Whenever they become societal assumptions or 'collective', such expectations can even guide or justify the actions of those who do not necessarily share them. Expectations always depend on a "process of continuous exchange of expectations", where "individual or collective actors influence collective expectations, [and]... are themselves subject to the influence of collective expectations" (Konrad, 2006: 431–432).

Expectations contain descriptions of future roles "for the self, others and artefacts" (van Lente, 1993: 195). Expectations entail a promise to fulfil those roles. Seen as promises on future commitments, shared expectations can turn into requirements for the actors enunciating or endorsing them, and so generate 'promise-requirement cycles' (van Lente, 1993: 191–193). "Behind the promise-requirement cycles lies the dynamic of expectations: as soon as expectations are shared, they assume a life of their own... they create a pattern into which the actors themselves may be locked" (van Lente and Rip, 1998: 217). Technology innovators become required to demonstrate progress towards fulfilling their techno-promises, while other actors who endorse them become required to provide support.

Besides providing political-financial support to technological innovators, "governments" and "others" play an essential role in converting promises into requirements. Such conversion crucially depends on their assessments, endorsement and support of technologists' promises (van Lente, 1993: 167; van Lente, 2000: 60; van Lente and Rip, 1998: 216). Thus governments and others mainly act as selectors of technological expectations, by contrast to technologists formulating and promoting techno-promises on their own behalf. Other actors can also represent and defend rhetorically the support given to technologists (van Lente, 1993: 160; van Lente, 2000: 54). Such spokespersons might be actors in universities, industries and even "within the government, which becomes more and more involved in technological developments" (van Lente, 1993: 160).

In such ways, expectations potentially legitimise actions, communicate intentions, attract other actors and protect a space for innovations (Geels and Smit, 2000: 882; van Lente, 1993: 185, 196). Aware of such power, actors strategically use expectations to influence other actors' views on technological futures in order to favour their own interests. Promises and diffuse scenarios are used to convince funding organisations to invest money and attract other practitioners to join the development (Geels and Smit, 2000: 881). Technology innovators may exaggerate their promises:

"...in order to attract attention from (financial) sponsors, to stimulate agenda-setting processes (both technical and political) and to build 'protected spaces'... This performative dimension of future images provides a complementary interpretation

of the failure of some future speculations" (Geels and Smit, 2000: 881).

Especially in early stages of technological development, inflated prospects may lead to disappointment when earlier statements fail to match actual outcomes (Borup et al., 2006: 289). Those gaps can undermine the reputations of both individuals and entire innovation fields (Brown, 2003: 6; Brown et al., 2003: 1). Such "expectations and the frequent disappointments to which they lead are accompanied by serious costs in terms of reputations, misallocated resources and investment" (Borup et al., 2006: 290).

Drawing on the above insights about shared expectations and consequent requirements, this paper investigates how public authorities deployed technology and policy expectations in the UK biofuel controversy. We distinguish analytically between techno-promises and 'policy-promises', i.e. the promises made by public authorities for their future support after endorsing technological expectations from technology innovators.

2.2. UK biofuel policy: government's reputational stakes

Several scholars have looked at UK biofuel policy from various perspectives and pursuing different research questions. This section highlights previous analyses which closely relate to ours.

Two studies focused on UK stakeholder interactions, especially in the period after NGOs turned against biofuel targets in 2006–07. Despite that shift, "RTFO carbon and sustainability policy has latterly reflected the interests of DfT [Department for Transport] and organisations with an interest in motor vehicle-based mobility, interests that biofuels readily mesh with" (Upham et al., 2011: 2673). According to another study, NGOs' post-2007 opposition to biofuels was one driver prompting the UK government's decisions to launch the Gallagher Review in 2008 [official enquiry on biofuels] and eventually to slow-down UK biofuel targets in 2009 (Pilgrim and Harvey, 2010: 4.17–4.18). We interpret these decisions as government efforts to preserve its credibility and legitimacy vis-à-vis biofuel critics and innovators, while justifying current support as a requirement for future biofuel development.

Palmer analysed the RTFO's development from a "discursive-institutionalist perspective". To explain the discursive proximity between the UK government and biofuel industry just before the Gallagher Review, Palmer argued that biofuel advocates "successfully transplanted their ecomodernist discourse into policy makers' consciousness and vocabularies", because of its "superior appeal" compared to that of biofuel critics. Besides, the biofuel industry and the policy-making community had become economically interdependent, as "the former depended upon significant public sector investment and the latter viewed the development of 'advanced' biofuels as critical to Britain's future economic competitiveness" (Palmer, 2010: 1002–1005). Although a partial cognitive convergence between the UK government and biofuel industry may explain their discursive proximity, this happened while the UK government was promising lower support to first-generation biofuels than that demanded by the EU's targets and biofuels industry.

Analysing UK biofuel policy as policy appraisal, Dunlop investigated temporal tensions between policy and knowledge development. Despite acknowledging harmful impacts, the UK government only slowed down its biofuel targets, while rejecting calls for a policy moratorium. Dunlop infers broader considerations by the DfT, especially "sunk costs, in both economic and reputational terms". Industry had invested on the assumption that biofuel targets would rise, so "any radical re-thinking of policy would not only have been legally and economically questionable but would also have fatally undermined the DfT's credibility in the fuel sector" (Dunlop, 2010: 354). Building on Dunlop's inference,

we explain UK biofuel policy as maintaining policy-promises on incumbent biofuels, understood as necessary for technoscientific advance towards emerging biofuels.

Boucher investigated interactions between the UK biofuel controversy and regulatory development. Between 2007–11, "...a potentially important shift is observed in regulatory discourse. Just as the framing of the technology in the controversy was increasingly reduced to GHG [greenhouse-gas] emissions with peripheral reference to social and environmental sustainability, government documents also increasingly eschewed reference to improving energy security and rural economies" (Boucher, 2012: 152). Observing a similar trend in policy discourse, we link this with technological expectations for advanced biofuels.

Extending previous analyses of UK biofuel policy, we explain decade-long changes through a distinctive perspective on technological expectations. We emphasise the UK government's cautious approach in promising lower support to first-generation biofuels, relative to the EU targets and industry demands. We also show how the UK government's 'reputational sunk costs' were linked to the argument justifying biofuel targets for first-generation biofuels as necessary for technoscientific advance in second-generation biofuels. As an implicit rationale behind reputational sunk costs: Public authorities must fulfil their previous policy-promises as a requirement to preserve their technology policy effectiveness in mobilising prospective investors in the future. The linkage with technoscientific advance can be better explained through promise-requirement cycles, i.e. maintaining current targets for first-generation biofuels as means to engage prospective innovators in a promise-requirement cycle on second-generation biofuels.

2.3. Materials and methods

This paper analyses official documents issued during 2000–2012 by several UK and EU public authorities in their own name (see Fig. 1). In reconstructing their chronological sequence, we traced backwards the references in the official documents and websites of the UK Government Departments involved in biofuel policy. Their official documents were issued in the name of the UK government. Complementing those documents are official documents from the European Commission and Council and the Gallagher Review from the DfT's Renewable Fuels Agency (RFA).

A special focus is the official correspondence of the Environment, Food and Rural Affairs Committee (EFRAC) and the Environmental Audit Committee (EAC). Both criticised the UK government's biofuel policymaking during 2003–2008. Parliamentary Select Committees scrutinise UK government policies and publish official reports to which the UK government should reply within two months (HoC_IO, 2009: 5).

In analysing all documents, we looked for expectations of second-generation biofuels. We also looked for convergent, divergent and shifting expectations on whether support for first-generation biofuels would be a requirement for industry to develop second-generation biofuels, or else a barrier to their development. Once identified, such technological expectations were used to compare the specific biofuel visions among public authorities.

3. Policy engagement: a low starting point

Until 2002 UK public authorities and industry shared collective expectations for hydrogen as the "fuel of the future" (DETR, 2000: 29; EAC, 2001: Paragraph 86; RCEP, 1997: 34–35), while biofuels were marginal in government research initiatives and financial support for alternative fuels (DETR, 2000: 29; DTI, 2001; 2002: 23; EST, 2002: 11; HoC_IO, 2002: 57). Biofuels were dismissed as

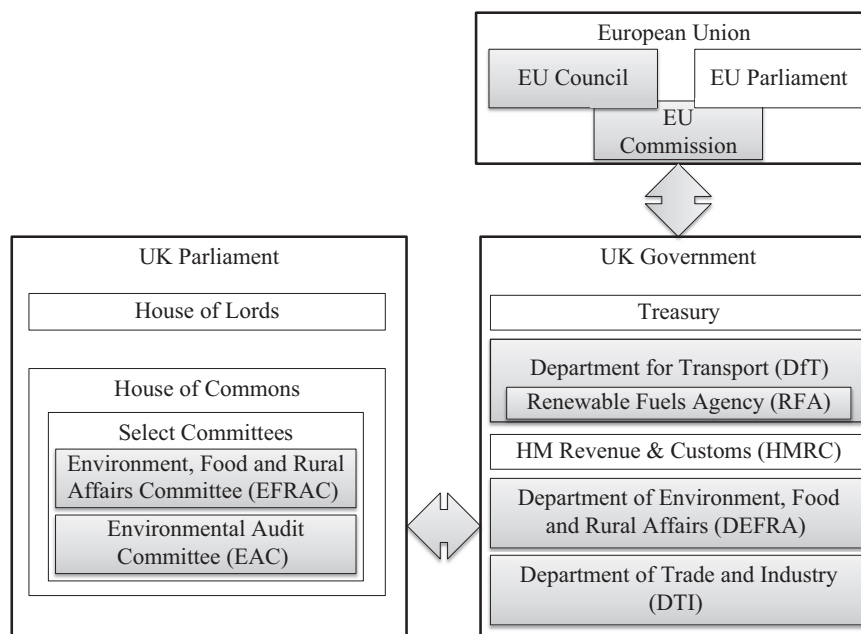


Fig. 1. Public authorities map.

unsuitable for the UK for various reasons. Experts had voiced concerns about overall GHG savings and adverse environmental effects from feedstock cultivation for biofuels (RCEP, 1994: 142). Within the Department for the Environment, Transport and the Regions (DETR),² the Alternative Fuels Group had raised doubts about biofuels' benefits for carbon abatement and fuel security (DETR, 2000: 29).

In July 2002 the UK government introduced the first financial incentive: a fuel duty discount only for biodiesel (20p per litre). Previous proposals from Liberal Democrats to further increase support and extend it to bioethanol were dismissed as 'premature' by the UK government, which raised doubts about their economic, practical and environmental benefits (HoC JO, 2002: 23).

Meanwhile, in November 2001 the European Commission had started formal negotiations on an EU Directive on Biofuels (EC, 2001), which became law in May 2003 (EU, 2003). The Directive set non-binding "reference" targets requiring an increasing proportion of all diesel and petrol sold in the Member States to be biofuels, precisely: 2% by 2005 and 5.75% by 2010 per energy content. Member States had the option to set their own "indicative" targets and choose how to implement them, but were required to justify any divergence from the EU-wide reference targets and report on progress towards the targets chosen.

By 2003 various public authorities were promoting biofuels through optimistic expectations for future benefits in mitigating climate change and enhancing fuel security in road transport,

i.e. in reducing GHG emissions and diversifying transport fuel supplies, as well as in fostering the rural economy, i.e. in creating new markets for non-food crops and jobs in the biofuel supply-chain (EC, 2001: 31–32; EFRAC, 2003: 5; : 42–44).

Three months before the 2003 EU Directive, the Department of Trade and Industry (DTI)³ published an Energy White Paper. While still preferring hydrogen, the UK government now promoted biofuels as an "important potential route for achieving the goal of zero-carbon transport, creating new opportunities for agriculture in the UK as well as globally" (DTI, 2003: 69). However, uncertainties and disagreements persisted, especially about how to ensure the sustainability of biofuels.

In 2003 Parliament's Environment, Food and Rural Affairs Committee (EFRAC) sent a report to the Department of Environment, Food and Rural Affairs (DEFRA),⁴ questioning how UK biofuel policy could contribute to DEFRA's policy objectives. Supporting biofuels, the EFRAC welcomed the policy change: the UK had to significantly reduce its GHG emissions, and biofuels were an "attractive means of doing so for transport", at least "until hydrogen fuel cells become commercially viable" (EFRAC, 2003: 11). The EFRAC lamented that the UK government appeared as "still testing the waters" for developing a domestic biofuel industry, with its weak support reflecting its "ambivalent attitude" (EFRAC, 2003: 18). However, the EFRAC also acknowledged the lack of clear evidence on both future benefits for the rural economy and environmental impacts of expanding biofuel production in the UK and elsewhere. On these grounds, it recommended the development of an auditing system on biofuels' environmental and socio-economic impacts in producer countries (EFRAC, 2003: 12, 18).

² Between 2001 and 02 the Department of the Environment, Transport and the Regions (DETR) was reformed in Department for Transport, Local Government and the Regions (DTLR). The responsibilities for environmental and rural policies were transferred to the newly formed Department for Environment, Food and Rural Affairs (Defra). Established in 2002, Defra has been responsible for the environmental, agricultural and rural aspects of the UK biofuel policy since then. In 2002 the DTLR was reformed again in Department for Transport (DfT), with its remit narrowed to transport policies. The DfT has been in charge of the practical implementation of all financial incentives for biofuels since then. The HM Customs and Excise Department – which after the merger with Inland Revenue in 2005 became the current HM Revenue & Customs (HMRC) – has collaborated with the DfT in implementing both financial supporting schemes. Meanwhile, the Treasury has been responsible for the fiscal side of financial incentives since their inception (EFRAC, 2004-01-27; 1, 17)

³ The DTI led on energy policy at the time. In 2007 the DTI was reformed in the Department for Business, Enterprise and Regulatory Reform (BERR). A year later, it handed over energy policy to the newly formed Department of Energy and Climate Change (DECC), which has led on energy policy since then. These Departments have dealt with the energy policy aspects of biofuel policy

⁴ EFRAC's remit is "to examine the expenditure, administration, and policy" of DEFRA "and its associated bodies" (EFRAC, 2003). Established in 2002, the DEFRA had become responsible for the environmental-agricultural issues of the newly emerging UK biofuel policy (EFRAC, 2003: 17)

In reply to EFRAC, the UK government did not intend to establish industries mostly importing biofuels (EFRAC, 2004gr: 8) and/or “based on excessive... subsidy not justified by clear and well-established evidence of environmental, social and economic benefits... for both the tax-payer and the economy as a whole” (EFRAC, 2004gr: 6). Furthermore, the current duty discount for biodiesel was introduced only in July 2002, and the duty discount for bioethanol was going to be introduced only in January 2005, so it was “too early to judge how far the policy has been a success” (EFRAC, 2004gr: 8). The UK government also doubted the practical feasibility of an auditing system: “auditing the environmental impact of biofuels in the countries in which they are produced is extremely problematic and it is unlikely that a cost-effective and robust system of regulation could be introduced” (EFRAC, 2004gr: 9).

In the 2004 report on progress to the European Commission, the UK government announced only a 0.3% per volume target for 2005, much lower than the EU's 2% per energy content.⁵ As justifications for the lower target, financial “incentives have only been recently introduced”, and from the “UK's low starting point” (HM Govt, 2004: 8). In that report, it also raised doubts about the economic, fuel security and environmental benefits of higher support to biofuels:

“Industry has called for a higher level of incentive, but the cost of the current incentive already outweighs the monetised carbon benefit, and biofuels are currently an expensive method of carbon abatement... Our economic analysis suggests that greater incentive levels at this time would largely result in imports, including from outside the EU. This would limit the potential benefits to the UK and broader EU agricultural & rural sectors of a new market. In addition, there is strong concern that greater demand from the EU for biofuel feedstocks could lead to further deforestation in South East Asia and South America – thereby undermining the environmental benefit sought through the measure” (HM Govt, 2004: 2).

Accommodating the EU Directive, in November 2005 the UK government eventually promised higher support to available biofuels by announcing the future implementation of the Renewable Transport Fuel Obligation (RTFO). From April 2008 the RTFO would set a legal obligation on large transport fuel suppliers to blend increasing annual rates of biofuels in the road-transport fuels they supplied to the UK (HM Govt, 2005: 3). Announced to rise only to 5% per volume by 2010/11, RTFO's mandatory targets were still more cautious than the EU's higher reference target of 5.75% per energy content⁶ by 2010.

Overcoming its previous objections, the UK government also announced the future implementation of an “assurance scheme alongside the Obligation to ensure, as far as possible, biofuels are produced from sustainable sources” (HM Govt, 2006: Section 1). However, controversy soon deepened over how and when to evaluate the sustainability of biomass sources for biofuels.

4. Policy implementation: sustainability issues

By 2006–2007 first-generation biofuels were widely recognised as environmentally and socio-economically problematic (Boucher, 2012: 150; Dunlop, 2010: 352; Palmer, 2010: 999). To justify current targets, the future development of effective sustainability standards and second-generation biofuels had become crucial. Yet great uncertainty persisted about when these developments

would materialise. UK biofuel policy faced a dilemma: whether the UK's mandatory targets should await the development of sustainability standards and more sustainable biofuels, or else be maintained as a means to stimulate these developments.

By 2006 the EFRAC had reversed its earlier vision on current biofuels, which do “not present the most effective or efficient way of making a significant difference to the UK's carbon emissions in the long term” (EFRAC, 2006: 5). It further criticised the UK government for a “disproportionate degree” of support for transport biofuels, to the detriment of other bioenergy forms, which offered greater carbon savings (EFRAC, 2006: 3). It recommended that any biomass use for energy should be evaluated for impacts on land use, including food security (EFRAC, 2006: 32–35).

The EFRAC was also “extremely disappointed” by the announcement that biofuel auditing would not be enforced in the initial phase of the RTFO. Without sustainability standards, the RTFO would effectively favour first-generation biofuels – readily available and cheaper to buy, over second-generation biofuels – offering greater GHG savings. Thus it warned that biofuel support as currently set “could ‘lock in’ first-generation biofuel technologies and so damage the prospects for development and use of more advanced fuels” (EFRAC, 2006: 45–46). Second-generation biofuels would need “concerted and sustained investment” in order to become commercially viable, partly by adapting the RTFO to reward biofuels according to their specific GHG abatement (EFRAC, 2006: 3). Thus at issue was how to protect a space for development of environmentally more sustainable biofuels.

The UK government raised practical difficulties about those proposals. Although “integrating GHG fully into the RTFO was fundamental to... achieve its objectives,... the additional complexity, legal uncertainty and short term implications of incentivising GHG savings directly suggested that a staged approach toward integration was advisable” (EFRAC, 2006gr: 10–11). The UK government was “keen to move toward direct incentivisation as soon as it becomes feasible to do so” (EFRAC, 2006gr: 10–11) and reaffirmed its commitment to encourage the development of biofuels offering greater GHG savings (EFRAC, 2006gr: 5–6).

Despite the controversy, in March 2007 the European Council agreed to a further biofuel target of 10% per energy content⁷ by 2020. Although the new target was higher and mandatory, it set a slower increase in annual rates than the 2003 Directive had done. Also the 10% target was subject to pre-conditions, especially the sustainability of eligible biofuels and the availability of second-generation biofuels (EU Council, 2007: 21).

On that basis, in May 2007 the UK government reconfirmed the pre-condition of “second-generation biofuels becoming commercially available” for the new target (DEFRA et al., 2007: 8), and of sustainability standards being enforced for any RTFO levels above 5% per volume after 2011 (DEFRA, 2007: 33). The UK government promoted first-generation biofuels as the only available option to fulfil EU obligations, while acknowledging that transport biofuels were the least cost-effective biomass conversion for reducing GHG emissions. Biomass conversion priorities need not reflect that hierarchy because “it does not take into account the relative importance of biomass fuel sources in delivering climate change goals and targets”, especially “in the transport sector for which there are few other options in the short to medium term” (DEFRA, 2007: 7).

The UK government then reinforced expectations for future improvements in environmental and socio-economic sustainability: “It is likely that by 2020 second-generation biofuel technologies will be in place. This should make the production of biofuels

⁵ 2% per energy content is equivalent to 2.5% per volume (RFA, 2008: 90)

⁶ 5.75% per energy content is equivalent to around 7% per volume (RFA, 2008: 90)

⁷ 10% per energy content is equivalent to 12.4% per volume (RFA, 2008: 90)

from land much more efficient, with a reduced area needed to produce a given volume of biofuels..." (DEFRA, 2007: 22).

In June 2007 the UK government reconfirmed its intention to postpone the introduction of a mandatory system of sustainability standards until after the RTFO's launch in April 2008. However, it also announced that biofuels would be rewarded according to their GHG savings from April 2010, and become eligible for support only if their feedstocks were certified as sustainable from April 2011 (HM Govt, 2008: Section 2).

Thus expectations for future improved sustainability served to justify rising future targets, especially in response to biofuel critics. Meanwhile the pre-conditions on the availability of second-generation biofuels and sustainability standards sent the biofuel industry a signal to develop the former and implement the latter. In these ways, the EU Council and UK government sought to find a future way out of their policy commitments to first-generation biofuels.

In its 2008 proposal for a Renewable Energy Directive, however, the European Commission did not include the EU Council's pre-condition on the availability of second-generation biofuels for the 2020 target. It justified the exclusion on the following grounds: "The main purpose of binding targets is to provide certainty for investors. Deferring a decision about whether a target is binding until a future event takes place is thus not appropriate" (EC, 2008: 13). Such pre-condition similarly conflicted with industry's demands for higher future targets as prior incentives for technological advance, especially for second-generation biofuels (EAC, 2008: Evidence 195).

5. Policy conflicts: debating routes toward second-generation biofuels

By 2008 the UK government was already justifying biofuel policy through three optimistic expectations: second-generation biofuels would soon overcome first-generation biofuels' problems; sustainability standards would soon be effective and implemented; and current first-generation targets would stimulate industry to fulfil the previous two expectations. The latter expectation was questioned by the Environmental Audit Committee (EAC).⁸

When the 'food versus fuel' controversy gained prominence in 2007–08, first-generation biofuels faced greater criticism regarding their GHG savings and wider drawbacks. Joining those criticisms and reiterating the EFRAC 2006 report, the EAC 2008 report advocated priority for the development of sustainability standards and second-generation biofuels. The EAC argued that "biofuels can reduce greenhouse gas emissions from road transport" and that second-generation biofuel technologies "might have a sustainable role in the future" (EAC, 2008: 3). However, it doubted that current sustainability standards could prevent all damage from first-generation biofuels and so proposed a moratorium on current biofuel targets. Current sustainability standards were ineffective because they omitted wider impacts, such as fertiliser and pesticide pollution, the destruction of carbon sinks internationally and worsening food security in developing countries (EAC, 2008: 14, 19, 22).

As grounds for a moratorium, this would delay biofuel expansion "until technology improves, robust mechanisms to prevent damaging land use change are developed, and international sustainability standards are agreed" (EAC, 2008: 3, 14). It strongly criticised the RTFO: "In the absence of such standards, the Government and EU have moved too quickly to stimulate the

use of biofuels" (EAC, 2008: 14). Finally, it warned that "it will take considerable courage for the Government and EU to admit that the current policy arrangements for biofuels are inappropriate" (EAC, 2008: 3). As the term 'courage' implied, a policy retreat on higher targets could undermine the EU's and UK government's credibility vis-à-vis biofuel suppliers, unlike the EAC, which had no responsibility towards them.

Responding to the EAC, the UK government rejected the moratorium proposal on several grounds. It would "mean missing an opportunity to make carbon savings" in a context of current targets already set at "cautious" levels. It would also mean "renewing on earlier commitments", upon which biofuel producers and fuel suppliers had already made investment decisions (EAC, 2008gr: 7). Moreover, it was not "feasible to wait for technological improvements before utilising biofuels" (EAC, 2008gr: 10–11). Rather, "It is by encouraging the first generation of biofuels that we can expect to move towards second-generation technology" (EAC, 2008gr: 14).

In other words, breaking previous policy-promises to support biofuels would have discouraged investment into biofuel technological advance. Locked into such policy-promises, the UK government argued that maintaining the current biofuel market was a requirement for the industry to "have any incentive to make technological developments leading to cheaper biofuels with better greenhouse gas savings" (EAC, 2008gr: 11–12). At the same time, it assured biofuel critics that it "will not support any increase beyond current targets without being satisfied that the conditions set by the March 2007 European Council are met" (EAC, 2008gr: 8).

In its counter-response, the EAC "urged the Government to resist attempts to increase EU biofuel targets" and contested all its arguments against a moratorium (EAC, 2008gr: 5). In particular, the EAC acknowledged "the concern for those that might have already invested in biofuels", but also contended that such "concern is outweighed by concerns about the potential harm that could arise if the development of biofuel continues without the necessary safeguards" (EAC, 2008gr: 4). Furthermore, "It will be much harder to take decisions about biofuels once an industry has fully established itself on a basis that may not be fully sustainable" (EAC, 2008gr: 4). Then citing the Royal Society, the EAC reiterated that current policy was "inadequate" as will direct investment into "more established near-term options... and little to the more promising long-term options" (as reported in EAC, 2008gr: 4), i.e. into first-generation at the expense of second-generation biofuels.

6. Policy slow-down: lower targets and delayed techno-expectations

Prompted by those disagreements and the wider public controversy (Palmer, 2010: 993, 1003–1004; Pilgrim and Harvey, 2010: 4.17–4.18), the UK government commissioned the DfT's Renewable Fuels Agency (RFA) to carry out an expert review of biofuel policy. Known as the Gallagher Review, the study reconfirmed the UK government's rationale that a moratorium would "reduce the ability of the biofuel industry to invest in new technologies or transform the sourcing of its feedstock to the more sustainable supplies necessary to create a truly sustainable industry"¹⁰ (RFA,

⁹ The DfT created the Renewable Fuels Agency (RFA) in 2007 and delegated to it the administration of the RTFO. In 2011, the RFA ceased to exist and the DfT retook direct control of the RTFO.

¹⁰ As Dunlop pointed out: "Of course, the fact that the body conducting the review—the RFA—had been created to implement the RTFO made it unlikely that such drastic action [a policy moratorium] would be recommended" (Dunlop, 2010: 353).

⁸ EAC's remit is "to consider to what extent the policies and programmes of all government departments and non-departmental public bodies contribute to environmental protection and sustainable development" (EAC, 2008).

2008: 66). Regarding the future availability of advanced biofuels, “a market share of 1–2% by energy of transport fuels by 2020 seems feasible” (RFA, 2008: 13, 44), likewise reinforcing technologically optimistic expectations.

However, the Gallagher Review also acknowledged the controversial drawbacks of available biofuels. An uncontrolled large-scale application could lead to direct and indirect land-use changes, which would eventually result in net increases in greenhouse-gases as well as unsustainable impacts on developing countries' local environment and socio-economic conditions. In particular, the displacement of existing agricultural land, due to biofuel demand, would lead to carbon sink destructions (e.g. deforestation), biodiversity losses, human rights' abuses and food insecurity in developing countries (RFA, 2008: 8, 18–19). On those grounds, it then advised the UK government to slow down the biofuel targets “until adequate controls to address [land] displacement effects are implemented and are demonstrated to be effective” (RFA, 2008: 8).

During 2007–2009 the UK government also accommodated critics, industry, and the EU by increasing R&D funds for second-generation biofuels. Such funds have been allocated through Research Councils, mainly the Engineering and Physical Sciences Research Council (EPSRC) and the Biotechnology and Biological Sciences Research Council (BBSRC), whose budgets have increased greatly since 2007 (UKERC, 2009). As part of its wider programme on ‘Sustainable Power Generation and Supply’ (Supergen), the EPSRC set up the Supergen Biomass and Bioenergy Consortium, researching also advanced biofuels; its total budget increased from £2.9 m during 2003–07 to £6.4 m during 2007–11. As its main conduit for bioenergy R&D funds, the BBSRC set up the Sustainable Bioenergy Centre (BSBEC) in 2009; with an initial funding of £27 m. The BSBEC was promoted as a “key contribution which will target research on the development of advanced bioenergy and biofuels” (DECC, 2009: 148), and “support the build-up of research capacity into how bioenergy can help replace fossil fuels with renewable, low-carbon alternatives” (DEFRA, 2007: 35). As a rationale for such R&D priorities, second-generation biofuels would use natural resources more efficiently and sustainably, i.e. by minimising land requirements and avoiding food crops.

By endorsing the Gallagher Review and expanding R&D funds for second-generation biofuels, the UK government sought to enhance the credibility of its policy rationale and expectations. Then, in its report on progress to the European Commission, it argued that “a more cautious approach to biofuel production is necessary” (HM Govt, 2008: Section 2). Accordingly, it announced the phasing out of biofuel duty discounts by March 2010,¹¹ and in April 2009 slowed down the RTFO's annual rates to reach 5%¹² per volume only in 2013/2014. Although reduced, RTFO's biofuels targets, combined with the higher EU target, “should still give incentive to the biofuels industry to invest in new technology and domestic capacity” (HM Govt, 2009: Section 1).

Meanwhile, the European Commission issued the Renewable Energy and Fuel Quality Directives¹³ (EU, 2009fq, 2009red), reconfirming the 10% per energy content target,¹⁴ but omitting any pre-condition on the availability of second-generation biofuel by 2020, despite the EU Council's 2007 proposal. Such a pre-condition also disappeared from UK policy documents.

Since then, technoscientific advance towards second-generation biofuels disappointed earlier expectations. Nevertheless, the UK government and European Commission have still promoted such expectations to justify their biofuel targets. Meanwhile the controversy has narrowed around GHG emissions from indirect land-use changes, somewhat losing its initial prominence (Boucher, 2012: 151–152).

In the 2012 UK Bioenergy Strategy, the UK government stated: “It is important that future policies and incentives are aligned to incentivise low risk areas that minimise technology and investment lock in to pathways that may become undesirable and minimise lock out of potential vital pathways” (DfT, 2012: 57). Although “low-risk areas” included second-generation biofuels, earlier technological expectations for them were slowed down: “Advanced biofuels could start playing an increasing role in reducing road transport emissions in the 2020 s” (DfT, 2012: 52). Still, “So long as the sustainability can be assured... some conventional biofuels can offer a cost effective contribution to reducing carbon emissions from road transport” (DfT, 2012: 41). Meanwhile civil servants were considering the earlier warnings from EFRAC:

Policy may lock in particular pathways, e.g. through investment decisions and several thousand jobs, so that government would face political difficulties in shifting its support to a different pathway later. Already the biofuel mandate may be locking in current biofuels. The UK government remains silent about any increase in the blending quota above 5% after the EU review due in 2014 (civil servant, interview, 22.05.12).

In 2012 the European Commission proposed amendments to the 2009 EU Directives, somewhat reversing its previous stance. While reconfirming the 10% target, it proposed to cap the contribution of first-generation biofuels from ‘food crops’ to 5% per energy content¹⁵ through 2020, to encourage “the transition towards advanced biofuels”.¹⁶ It also proposed better sustainability reporting by including indirect land-use changes. Although those proposals resemble an ultimatum to first-generation biofuel suppliers, the European Commission “also aims at protecting existing investments until 2020” (EC, 2012: 3, 8, 14).

7. Discussion: tensions among UK public authorities

From a low starting point, the UK government was obliged by the 2003 9 EU Directive to promise higher support to biofuels. Yet it announced significantly lower biofuel targets than those in the Directive. By 2008 UK targets were explicitly defended as ‘cautious’ in response to high-profile calls for a moratorium, and were eventually delayed in 2009. This caution relates to the risk of locking in a nascent industry for first-generation biofuels, which the UK government initially presented as environmentally and socio-economically risky and excessively expensive (EFRAC, 2004gr: 6; HM Govt, 2004: 2).

The UK government became constrained in multiple ways: by its EU obligations, by its dependence on a new-born UK biofuel industry necessary for fulfilling them, and by its need to establish

¹¹ As exception, the duty incentive for biodiesel from used cooking oil was later announced to remain in place until 31 March 2012.

¹² Against the 10% per energy content by 2020 – equivalent to 12.4% per volume (RFA, 2008: 90).

¹³ The 2009 Renewable Energy Directive and Fuel Quality Directive repealed the 2003's EU Biofuels Directive.

¹⁴ Now referred to any ‘renewable’ fuels, amidst expectations that these would be mainly biofuels in practice.

¹⁵ Equivalent to the estimated consumption level at the end of 2011 per energy content (EC, 2012: 14).

¹⁶ In the orientation debate on the EC's proposal, the UK delegation lamented that: “As currently drafted the proposed Directive *neither* adequately addresses Indirect Land Use Change (ILUC) emissions *nor* adequately encourages the transition to advanced biofuels” (underlined text in the original document). According to the UK delegation, the definitions of the biofuel feedstocks to include in the cap in support are incomplete, warranting the application of an ‘ILUC factor’ to make sure that all biofuels with excessive ILUC are included. Another concern was the design of EU biofuel targets. The UK delegation argued that, as currently designed, EU biofuel targets do not provide a real incentive to develop advanced biofuels (EU Council, 2013).

credible incentives for its technology policy. Since then the UK government started acting not only as selector, but also as promoter of technological expectations (as observed in other technological contexts by [van Lente, 1993](#): 160), though the latter role aimed primarily to maintain legitimacy towards technology innovators and Parliamentary critics. In doing so, the UK government deferred to industry's technological expectations: especially that second-generation biofuels could start replacing current ones before the 2020 deadline for EU targets. This “discourse transplantation” has been partially explained in cognitive terms – as resulting from the “superior appeal” of the biofuel industry's arguments ([Palmer, 2010](#): 1002, 1005). But the UK government was promising a lower support to first-generation biofuels than that demanded by the EU and biofuel industry, partly as means to ensure the fulfilment of expectations for second-generation biofuels.

During the 2006–2008 controversy on first-generation biofuels as unsustainable, the discursive space narrowed on GHG savings, while marginalising fuel security and rural economy as policy drivers ([Boucher, 2012](#): 152). Considered as mature technologies, incumbent first-generation biofuels had become controversial regarding their unsustainable biomass inputs. Meanwhile second-generation biofuels depended on emerging technologies gaining ‘collective expectations’ ([Konrad, 2006](#): 431), or at least widespread public endorsement among public authorities, as means to avoid negative effects of first-generation biofuels.

Facing the controversy, the UK government presented second-generation biofuels as if they were ‘self-justifying’ through an appeal to technological progress (as observed in other technological contexts by [van Lente and Rip, 1998](#): 222–223), which would provide greater environmental and socio-economic benefits. The UK government linked optimistic expectations for future sustainability standards, future second-generation biofuels and their dependence on current targets for first-generation biofuels.

The latter expectation failed to convince Parliamentary Select Committees. They argued that the UK government should withdraw support from available first-generation biofuels (i.e. current targets), which otherwise would deter or lock out second-generation biofuels. To avoid a lock-in, the government should promise future support exclusively to second-generation biofuels. In sociological terms, UK public authorities disagreed about whether targets for first-generation biofuels would protect a space for future second-generation biofuels or rather would impede them.

Such disagreements can be interpreted in relation to different institutional responsibilities toward promise-requirement cycles. According to theory, when technological expectations from technology innovators become increasingly shared, they are held responsible for their practical fulfilment by other actors willing to give political-financial support, e.g. public authorities. Conversely, the latter are held responsible for fulfilling their policy-promises of support. Accordingly, the promise-requirement cycle would mobilise various resources towards technoscientific advance. If technological expectations are disappointed, however, then technology innovators are blamed for their practical failure, and public authorities may redirect support ([van Lente, 1993, 2000](#); [van Lente and Rip, 1998](#)).

When the UK government and Parliamentary Committees persistently disagreed over biofuel targets, the disagreements arose partly from their different reputational stakes towards promise-requirement cycles. Parliamentary Select Committees have their reputation dependent on pursuing ultimate policy goals such as sustainability and holding other public authorities accountable for doing so ([HoC_IO, 2009](#)). Acting as advisors and monitors of the UK government, these Committees do not need to promise support to industry. By contrast, the UK government,

as the executive public authority in technology policy, had multiple reputational stakes; towards the EU, the biofuel industry and Parliament. The government was the public authority directly held responsible for policy-promises of support, especially toward technology innovators (as also inferred by [Dunlop, 2010](#): 354).

Through technological expectations for second-generation biofuels, current targets for first-generation biofuels served as ‘wishful enactments of a desired future’ ([Borup et al., 2006](#): 286). Along with greater funding for biofuels R&D, the UK government presented its targets as necessary to stimulate biofuel innovators to fulfil future EU targets with second-generation biofuels. Beyond a cognitive basis, such expectations also have a performative role in defining institutional responsibilities. For the UK government, such responsibilities entailed a policy dilemma, whose implicit rationale combines elements that remained separate in previous analyses of UK biofuel policy.

8. Conclusion: policy-promise lock-ins

Encouraging a transition to preferable emerging technologies may entail a dilemma for executive public authorities in technology policy, namely: Fulfilling previous policy-promises of support is a requirement to maintain credibility towards current and prospective technology innovators. Otherwise, betraying previous policy-promises to the incumbent regime could undermine the effectiveness of future technology policy in mobilising current and prospective technology innovators on which public authorities depend. Given such reputational stakes, executive public authorities may delay a complete redirection of support from incumbent to preferable emerging technologies, presenting such delay as instrumental for stimulating technoscientific advancement toward the latter.

This dilemma can be theorised as a *policy-promise lock-in*. In such situations, previous policy-commitments towards technology innovators of incumbent technologies – potentially controversial and driven by several imperatives – are officially justified as necessary for the development of preferable emerging technologies. When trapped in a policy-promise lock-in, executive public authorities may endorse technological expectations for emerging technologies accordingly. In doing so, they aim to protect their reputation in technology policy, avoid responsibility for any disappointment about technological development, and promote technology development per se – the UK government's officially stated aim in biofuel policy.

Given its EU obligations, the UK government's dependence on first-generation biofuel suppliers drove policy-promises to that industry, thus imposing ‘reputational sunk-costs’ on the DfT (cf. [Dunlop, 2010](#): 354). Those reputational stakes were linked to technoscientific advance through expectations for second-generation biofuels. For the UK government, those expectations justified short-term support for incumbent biofuels, but potentially resulted in a lock-in ([van Lente and Rip, 1998](#): 217).

Executive public authorities can set temporal limits to their policy-promises. As the biofuel controversy emerged, in 2007 the EU Council and UK government subjected their 2020 target to a pre-condition on the future availability of second-generation biofuels. In sociological terms, they made their policy-promises conditional upon technology innovators fulfilling their own technological expectations. Conflicting with its prior commitments to the EU and biofuel industry, in 2009 the UK government sought wider legitimacy by slowing down UK biofuel targets, while referring to doubts about sustainability in the Gallagher Review. This prefigured the later caution of the European Commission's 2012 proposal.

Despite omitting any pre-condition for the availability of second-generation biofuels in the 2009 Directives, the European Commission eventually proposed in 2012 to cap support for first-generation biofuels at the current 5% level – only half the 10% target for 2020. Like the UK's target slow-down, the Commission's proposal somewhat accommodated controversy over first-generation biofuels' unsustainable feedstocks, while still ensuring them short-term support. In such ways, executive public executive authorities sought to minimise future risks of reputational damage towards publics as well as technology innovators.

In sum, promise-requirement cycles link the UK government's reputational sunk-costs towards first-generation biofuel suppliers with future technoscientific advance in second-generation biofuels. Such linkage extends insights of previous analyses of UK biofuel policy. For broader relevance, a 'policy-promise lock-in' describes a policy dilemma about distributing support between incumbent versus emergent and preferable technological systems, whereby both need state support. Thus the sociology of expectations – previously applied to technological expectations from technology innovators – can be extended to analyse public authorities.

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